Fact Sheet:

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SEISMIC EVALUATION AND REHABILITATION RESEARCH PROGRAM

The Problem

Military facilities must withstand earthquakes to provide life safety, and to support mission readiness and post-earthquake relief. Recent earthquakes show the vulnerabilities of pre-1970s reinforced concrete and masonry structures and welded steel frames, which are typical of military facilities. These earthquakes also showed the vulnerabilities of critical equipment.

In 1990, the U.S. Congress reauthorized the National Earthquake Hazards Reduction Program Act, P.L. 101-614, requiring that standards be adopted for seismically assessing and upgrading all existing vulnerable federal buildings. In 1994, the President signed Executive Order (EO) 12941 implementing the law. The EO requires that all existing federal buildings be screened for seismic vulnerabilities and that cost estimates for mitigating the vulnerabilities be developed by 1998. It further requires that the Federal Emergency Management Agency (FEMA) report by 2000 on how all federal agencies will achieve economically feasible seismic hazard mitigation. Substantial hazard mitigation efforts will likely develop. The Department of Defense owns or leases over 75% of all federal buildings and is thus the largest stakeholder in implementing the EO and any future mitigation programs.

Current technologies limit the cost-effectiveness of both hazard assessment and hazard mitigation. Condition assessment of existing structural systems is difficult and often inaccurate. Rehabilitation techniques usually rely on strengthening and stiffening measures that are costly and architecturally and functionally intrusive.

The private sector has been slow to invest in research to develop or validate new technologies, and little publicly-supported research has focused on existing buildings.

The Technology

The U.S. Army Construction Engineering Research Laboratories (CERL) are developing improved seismic design and analysis procedures, keying on areas of need specific to military installations. Ongoing and planned research, development, test and evaluation (RDT&E) work develops a technology base to determine the seismic capacities of buildings and installed equipment; produces cost-effective means of seismically upgrading structures; creates automated assessment and rehabilitation tools for program management; and designs critical equipment protection systems. CERL also proposes sponsor-funded field demonstration and technology transfer projects that mature these technologies.

Benefits

This research will improve mission readiness and life safety, reduce losses in future earthquakes, reduce vulnerability assessment costs, and provide more cost-effective methods for rehabilitation. The estimated cost for the preliminary vulnerability assessments alone is $25 million for the Army, with similar costs for the Air Force.

The Army has about 123,000 buildings on its installations in the Continental United States (CONUS). Of this total, approximately 19,000 are in areas of high potential seismic activity (seismicity); 30,000 are in areas of moderate seismicity; and 74,000 are in areas of low seismicity. Based on actual seismic screening and evaluation efforts at key Army installations to date, the estimated total number of Army buildings in the CONUS that are seismically vulnerable is approximately 4,500. Using actual evaluation costs and hazard mitigation cost projections using the results of a 1993 FEMA study, the estimated total seismic evaluation and rehabilitation cost for the entire CONUS Army inventory is approximately $1.8 billion, using the technologies that are in common use today.

The use of more accurate evaluation and analysis techniques will reduce the number of buildings that are deemed to be seismically vulnerable; current techniques often employ very conservative assumptions, because of the

unknowns involved. This reduction will lead to lower rehabilitation requirements. Improved rehabilitation technologies will provide large rehabilitation cost savings. A 20% reduction in the number of facilities requiring rehabilitation and a 25% reduction in actual rehabilitation costs leads to a projected cost savings of over $520 million for the Army, using improved technologies. These savings projections are more conservative than those recently published in open literature, which run as high as 30%-50%. Extending these savings to the Air Force and Navy inventories increases the potential payoffs.

Technology Partners

CERL's mission is supported by its high technical standing. CERL recently upgraded its shaking table, making it the first large U.S. triaxial shaking table. CERL is working cooperatively with other leading U.S. research agencies. The National Center for Earthquake Engineering Research jointly funded a CERL project examining viscoelastic dampers to rehabilitate a reinforced concrete structure. CERL works closely with seismic researchers sponsored by the National Science Foundation (NSF). CERL closely works with the National Institute of Standards and Technology (NIST), keying on a shared interest in enhanced technology transfer. Through CERL and NIST involvement with the Interagency Committee on Seismic Safety in Construction, technologies are easily transferred to other federal agencies. CERL actively works with other agencies in the Army Seismic Risk Mitigation Program to perform seismic screening and analysis, and to project future hazard mitigation efforts.

Point of Contact

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